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Three authorities in the field of education offer their views on the technological revolution in instructional materials. Fred Hechinger, education editor of the New York Times, discusses the range of devices available, from film strips to computers. He feels that industry is oversold on the future of educational technology, both because of the generally conservative views of educators and the misunderstandings prevalent about the process of education. John Henry Martin, Senior Vice-President of Responsive Environments Cooporation, designates American education, particularly urban education, a complete failure. He cites the benefits to be gained from applying dollar value productivity measures to the acquisition of instructional materials and media. What is needed is a better understanding of the process of learning itself, and an application of that understanding to media development and use. Louis B. Wright, director of the Folger Shakespeare Library, takes a social historian's viewpoint of the process of education. He feels that the technological revolution has not yet faced the unchanging character of human nature. The control and manipulation of technology for humane ends, he concludes, is a great challenge. (JY)

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The Electronic Revolution in the Classroom: Promise or Threat?

A discussion by

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Moderator:
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FRED M. HECHINGER
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at a public meeting of the
Council for Basic Education
Washington, D. C.
October 27, 1967

COUNCIL FOR BASIC EDUCATION
WASHINGTON, D. C.

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The Electronic Revolution in the Classroom: Promise or Threat?

Welcoming remarks by Mrs. Barry Bingham:

Good evening, ladies and gentlemen. I am president of the Council for Basic Education and I am happy to welcome you here this evening. During its eleven years the Council has wrestled with what is certainly the most important question of this or any other day, the proper education of the young. This, I take it, is the art of guiding and goading them out of the savagery and disorder of the nursery into what Plato called some likeness and sympathy with the life of reason, and this is an undertaking of such complexity and subtlety that it has been likened to the black arts. You remember that John Donne thought that to find "what wind serves to advance an honest mind" is just about as difficult as to "get with child a mandrake root." Now we cannot expect any of our speakers to carry out either one of those assignments this evening, but I'm sure they will shed a great deal of light on what is a very pressing and a very relevant problem in the schools today. And so without taking your time and theirs any further, I shall turn you over to our accomplished chairman, Mr. Clifton Fadiman, who will introduce the speakers and chair the evening.

Clifton Fadiman:

You all have programs so that you know what the names of our speakers are and what the subject of this evening's meeting is. We have these meetings every year; we have had several successful ones in the last few years, and we anticipate that this evening will be just as interesting as those that have preceded it. Our topic is "The Electronic Revolution in the Classroom: Promise or Threat?" There is always a possibility, of course, that the electronic revolution may be neither a promise nor a threat but something in between, but that wouldn't make so good a subject so we have carefully worked out the title so as to insure some controversy.

Our first speaker, though comparatively a young man, is still, I suppose, one who might be called the dean of educational journalists in our country. He occupies, I should think, the leading position in his field, being the education editor of *The New York Times*—this is not intended as a slight to the Washington papers—and has been occupying that position for the last eight years or so. He is the recipient of various honorary awards, was in 1956 the president of the Education Writers Association, and is the author of various books, including *The Big Red Schoolhouse* and *Teen-Age Tyranny*, written in collaboration with his wife. I don't quite know what the point of view is that Mr. Hechinger is going to espouse, but I do know, from being familiar with his work, that of all the journalists operating in this interesting field, he is certainly as well equipped to tell us up-to-date news about the electronic revolution in our classrooms, if there is one, as anyone else. Mr. Hechinger.

Fred M. Hechinger:

I'd like to start with a confession. While I use the typewriter and occasionally even the electric can opener, I share with most normal human beings a certain fear of technology. It is a fear that is occasionally reinforced, as it was the other day. I was about to leave on a plane from a New York airport, and was standing at the runway, ready to take off—at least I was ready to take off, the pilot wasn't—and after about fifteen minutes the pilot announced that the computer, which, at that point, I suppose, was in charge of our lives, had scrambled all the Eastern flight patterns and people had to be called in to unscramble them. I picked up the other day a United Press International dispatch which reported a meeting at which Robert Hutchins spoke and which dealt with education in the twenty-first century. To my great surprise I saw in this report that "most of the instruction and testing would in the future be handled by computers." The teachers might go from house to house, like visiting nurses. And this dream, which to some mothers might sound like something of a nightmare, was explained further by Mr. Hutchins. He said, "We are on the verge of a technological revolution in education. It may go so far as to dissolve the institutions we have known or to make them largely unrecognizable." In laying out my position tonight I'm not going to be quite as radical.

I think the basic problem of the technological revolution in education is also the basic problem of contemporary American life. The

hucksters overstate the case, diagnosing a revolution where there is barely the beginning of a potential trend. And the manufacturers who, in the first place, have hired the hucksters, try to push their products, which you might describe as educational vehicles, without very much concern for those who will ride in them, and with not much attention to the educational road safety of these vehicles. Moreover, I think they talk about questions of efficiency frequently without having first determined how much efficiency is salable in education, and without having made the effort to persuade educators that efficiency, even in education, is not necessarily subversive.

On the other side of this fence, educators very frequently overstate their case: that the technology is a de-humanizing threat and that the machine can do nothing that the teacher cannot do better. The educational hucksters, for their part, extol the superior performance of the teacher, just as the industrial hucksters extol the superiority of the machine. Yet both of them, and their pedagogically rather isolationist friends, often overlook the fact that great numbers of pupils today remain, in effect, untouched by the human mind of good teaching. I think the basic problem, in other words, is to get away from the extremes of claims and resistance, and to get down to making the best use of new tools and new ideas where they are useful.

Now I would like, in order to make our discussion easier, to suggest the range of the technology, not in any way trying to be complete, but to give at least a sense of what types of devices are part of the technology. Many of these devices are not revolutionary at all, and they are certainly not new. They have been with us for a long time. Educationally speaking, probably the oldest of these devices is the film, in its various forms. Filmstrip, a little more primitive, is perhaps even older. Now there is, I think every good teacher knows, a great deal to be offered by good films, there are some excellent films available to the schools, and they are very rarely used. There are some superb films which deal with drama, and the interpretation of drama. There's a film that has always stuck in my mind although I cannot give you the name of the producer. I saw it many years ago, and I suppose the fact that I remember it so clearly is an indication that it was an extremely good teaching instrument. It was called "The Face of Lincoln." And the man who starred in this film—the only actor in the film—a teacher, happened to be a man of a rather unique combination of talents: he was a sculptor and he was

an historian. And the film, the entire film, consisted of his shaping, beginning with a piece of clay, the face of Lincoln. And as he shaped the face he told the history of Lincoln—his life, his battles. And it was very difficult for any pupil, young or adult, to forget this experience and, therefore, I think, it was good teaching, and certainly a part of the technology, a sample of the technology that seems extremely useful.

Another old aspect of the technology is radio. Some very good things have been done on radio to help the schools, and again relatively little use has been made of it. Best use of school radio has probably been made in Great Britain, where not only has the medium been used extensively, but the best practitioners in the field, the top commentators, traditionally have been used to work for school radio. The people who commented on the British contemporary political scene very frequently devised the same kind of lessons, the kind of instant news commentary on history and the past. I remember visiting one school in Britain, where the headmaster explained to me that before radio came in, he had always been a great believer in the outdoors, as many British educators are, in the gardens; and radio, at first, interfered with that. He solved the problem, he showed me, by piping the radio outside to the garden. Youngsters were listening to their radio lessons while they were planting flowers, a perfectly good combination.

Newer than radio is television. And now we are getting closer to the modern educational technology. The most recent addition, perhaps, has been the opening of the University of the Air, a series of courses, given each Saturday, which people can take for credit. They may take their examinations on participating college and university campuses. It seems to me an excellent idea, or it seemed to me an excellent idea, until I saw the first lesson. It documented to me —the lesson that I happened to see—that there are great dangers in the television technology. One danger is that you take the bad lecturer out of the classroom and expose him to a mass audience, a less captive audience than in the classroom. But this is not the fault of the technology. The fault is on the other side of the fence because it is undoubtedly true that the same poor lecturer would be equally inadequate in the classroom as he is in his use of the technology. As a matter of fact, the technology in this case might offer something of a reform device because for the first time more people can form their judgment as to how bad education really is and demand something better.

Equally new and revolutionary has been the announcement, about two weeks ago, of the introduction of high school equivalency courses on television, which, together with a set of materials which students may buy at relatively low cost, would permit those who have not finished high school to complete their high school courses and in the participating states take the high school tests that lead to a diploma. Obviously, in teacher training, television is a great tool. Most of the important medical schools today use television in their operating theatres, and this has made an enormous difference in the training of physicians. While the students in the past could barely see the outlines of the people moving in the center of the theatre, they can now literally follow the hands of the surgeon as he performs an operation.

Television is also a good example of the extreme resistance of much of education to all aspects of the educational technology. I remember when, at one of our great universities in the early days of educational television, a professor was asked to appear on television. He refused, and he gave as his reason that to do so would force him to rearrange his notes, which, I am sure, was long overdue.

One of the problems, I think, confronting the educational technology in television (and this is even more blatantly true in the more up-to-date technology to which I'll come in a minute) is that the teacher-training institutions make very little allowance for the existence of the new technology. Most teacher-training institutions approach the technology in a very peculiar way. They usually add a two- or three-credit course in the use of audio-visual aids—that terrible term—somewhere along the line of the curriculum, usually toward the end. This, it has always seemed to me, is a little as though we trained all our teachers without ever giving them a book, and then toward the end of their academic careers gave them a three-credit course in the use of books. As long as we treat the new technology in that fashion it is not likely to be used very extensively and in a very integrated fashion as part of the curriculum.

The beginning, however, of the truly new technology was the teaching machine. I can't date it exactly, but I think if we said about seven or eight years ago that would probably be about right. And the teaching machine was virtually killed by the exploiters. It was oversold, it was sold by door-to-door salesmen, it was sold in shiny plastic containers with very little to put into the containers. And so, while the teaching machine, or programmed learning as it is pro-

fessionally known, has a great deal to offer, it may have to be reborn under more scholarly auspices before it will really make an impact on American education. It has, however, in the meantime, even with its faulty introduction, served education in some fashion because it has forced educators, teachers, and textbook writers to re-examine the way in which the curriculum can best be presented. Since the teaching machine, or programmed instruction, requires that the subject be introduced in a rather systematic fashion, it has led to a re-examination of the curriculum, and I think it has improved education because of that.

Now we come to the most up-to-date aspect of the revolution, that part that is alone associated in the public mind with the new technology—I think mistakenly so—the computer and everything that is related to it. I think it requires very little discussion or documentation to agree that the computer holds enormous promise in certain areas, such as the promise for the retrieval of information in libraries; the promise of permitting the student literally to dial a lesson, as is now already being done in some experimental areas, to dial a film, a performance, a concert, a language lesson, almost anything, to be viewed either in a central meeting point, or perhaps even in the student's home or dormitory.

Equally clear is it that computerized education has enormous potential for that part of education that requires drill and practice, as in the non-computerized version we have already found out in the use of language laboratories. The problem to be faced is that there is a vast confusion in many people's minds, as they talk about the future of the computer, between certain aspects of training and other aspects of education. And the most unfortunate thing that has happened to the computer, to the technological revolution, if you want to use that term, is that far too often the armed forces and industry have been used as the example of the potential of computerized education.

Now army or armed forces training and industrial training is a very important aspect of national life, but it is not really education in the sense that we talk about in discussing education in the schools. It is a disservice to the revolution to take so many of the examples of what it might eventually do from the military and from industry. It is a disservice particularly because it has led, at the same time, to the adoption of a truly terrible new jargon which, if added to educationese and the sociologists' jargon that we already have to

contend with, is nothing to look forward to. I have been to too many meetings at which there seems to be nothing but "input" and "output" and "the state of the art," "the name of the game," and all that kind of business. I do not think education will gain from adaptation of that way of life to the school. The problems are vastly different in the schools. I was therefore disheartened to see, the other day, a report in my own newspaper that one of the new attempts to create courses adaptable to education in general through computerized learning has used Annapolis as the testing ground. The report said specifically that the Annapolis project offers a unique opportunity for industry to create a problem-solving partnership with the academic community. I beg to differ; I do not think it will. If anything, it will make a partnership impossible. The courses that are being worked on in this particular project are courses in economics, physics, and leadership or management psychology. Now this is a perfect example of what I think is the difficulty that arises if we do not differentiate sufficiently. It is perfectly feasible to use this kind of technological approach to physics instruction; I am horrified to think that it might ever be used in any course on management psychology. I am not sure that I would want to have a course in management psychology of any kind, but I think if it were taught by computer it would be even more dangerous.

There is an addition, I think, to the problem in differentiating between levels of education. Some aspects of teaching small children, I think, can be handled by the use of machines in a very limited way. But I also believe, very strongly, that dealing with small children must always remain very much a human and humane enterprise, and the technology has to be used very carefully. I know I have read that one of the computerized teaching devices greets its children with a mechanical "Good morning, John," or whatever the name is. I am afraid we already have too many phony good mornings to introduce children to a machine-made "good morning" at the beginning of the day. There is, however, a tremendous remedial potential, even for young children, in the use of machines, the use of typewriters that can be used to practice, in the approach to independent study in which children can proceed as fast as they like to.

Let me sum up. I think industry is being oversold on the future of the educational technology, both because of the conservatism among educators that has to be overcome, and also because I'm afraid industry does not quite understand the way education proceeds

in buying equipment. Education, in contrast to almost any other enterprise, does not subscribe to the great American custom of built-in obsolescence. Once a school system has bought a computer, in contrast to an industrial enterprise, it will not worry very much whether another system has a somewhat better or faster computer. A slow computer will be good for many, many years to come. And as a result of this miscalculation, industry is overpushing its hardware production and has been going far too slowly in the production of materials, the textbook-type materials, that would be used in the computer—the program of instruction that goes into the computer. At the same time, excessive conservatism on the part of educators poses a real danger that industry will be forced to determine what ought to be produced in the educational technology. I think it is well to remember that television has not gone away just because it was spurned by the intellectuals. Television has merely become increasingly depressing because the intellectuals refused to accept its coming. The same danger exists in educational technology. It will become worse if educators fail to take an interest in it, and if they fail not only to take an interest but to take the leadership in determining what is good and useful and what is bad and should not be encouraged. The question, I think, is not whether the teacher or the technology is better. A bad teacher is worse than anything because—see, there's my bias—he cannot be turned off. What is needed, I think, is an alliance between the best teachers and the best in technology.

Mr. Fadiman:

Our next speaker has boxed the educational compass. In the course of his career he has been a teacher in the elementary, junior and senior high schools and has also served as supervisor and principal. He has been educational consultant to several government committees. He was Special Assistant, for example, to the Director of the Office of Economic Opportunity in the War on Poverty. He has lectured and taught at various universities, and was formerly Superintendent of Schools in Freeport, New York, and then later in the city of Mount Vernon, New York. He is now Senior Vice-President of Responsive Environments Corporation, which produces the "talking typewriter" made famous by Professor O. K. Moore. Dr. Martin.

John Henry Martin:

Let me start as a technologist in education by first saying what technology is not and will not do, even at the risk of repeating Mr. Hechinger.

Technology will not, cannot, and I hope never will try to teach human values or virtues: generosity, love, gentleness, compassion, social affection, understanding. None of these will, I trust, in our lifetimes or those of our grandchildren, ever come to be from a machine. These can come only from human interaction, from the touch of another human being, from the look of another human being, from the consequences of how another human being makes you feel or how you make another human being feel. And the machine won't touch you, or feel you, or do this to you or with you. So there's a limitation in talking about technology as there is a limitation in talking about all kinds of monastic, individual learning. There is an important aspect of learning, however, which *is* monastic, which *is* individual, which *is* in isolation, and that is truly the area of exploration of the potential contribution by technology.

Having lived for thirty years in the world of education, which monthly is beset with another panacea, I do not look on technology as the panacea of April or October. However, there is one dynamic human attribute that can come from an interaction with properly programmed instructional material supplied by technology. It is a sense of competence, a sense of ability, a sense of internal worth. This is a consequence of a child manipulating a device which, by its very de-humanization, gives him the sense of power, gives him the sense of control, gives him the master baton that comes from being director of the learning process. What he takes from the machine he owes, literally, to no one else. I'll talk later about that greatest of infant capacities, that "do it myself" thrust which the schools not only ignore but, if any of it is left vestigially by the time children are eight, we squelch out of them completely by the time they're adolescents.

Education is the last handcraft institution left in our society. It is the last hand-operated, hand-labor field that still remains in mass institutions of our country. And it has many of the attributes of hand-craftedness. If we were to take the discussions of the virtues of the artist, of the craftsman, of the master teacher, and apply them to medieval craft guilds, we would find a series of parallels with

current educational thinking. A good deal of educational thinking these days says that reform comes from changing teacher behavior. Frankly it's a pretty dismal prospect. We hear sermonizing pleas that if we could raise the generality of teachers to the level of the craftsman, to the master teacher, our problems would be solved. This would be true, for if we could have mass produced the custom-made boots made for the aristocracy, then mankind would not have walked barefoot. But to continue to plead that the teacher needs to be made a master craftsman when we're talking about two million teachers is to ask for a return to a medieval craft state in order to justify the fact that our children remain ignorant.

I look on technology in an historical sense because I am old enough to remember listening to southern farmers say that no $2,000 tractor could ever replace a $50 mule and a $1 man. We're faced with the same problem of price and investment in the instruments of education that we've been faced with in each area of human productivity, that is, the initial cost of an instrument to do part of a complex of human crafts previously done by hand. Each such displacement of a piece of labor by a piece of technology has been resisted in terms of the machine's apparently higher cost. I can remember, many years ago, listening to why American vacuum cleaner manufacturers had no Chinese market. And when I asked, "Not even in the great and prosperous city of Singapore?" they said, "No, you can't sell a vacuum cleaner in a city where coolie labor to beat rugs is available for 10 cents a day." Well, coolie labor in the American classroom is escalating itself rapidly to ten and twelve and fourteen thousand dollars a year and the teachers are a part of the historical process where the cost of their ineffectiveness is going to be the thing that encourages educational technology.

The gigantic complex of the art of teaching children all things in our elementary schools, where the teacher is fragmentarily trained to be child psychologist, guidance counselor, family counselor, geographer, historian, mathematician, pseudo-scientist, and so forth—this complex of tasks is both fragmentarily taught and erratically accomplished. Most specifically, the central task of the schools is the teaching of fundamental literacy, the root intellectual skill upon which all academic learning is subsequently based, the foundation stone of intellectuality, the basis of academic progress. In this area we find the most recent study showing that, from a large sampling of teachers across the country, less than 2½ hours of collegiate credit

was viewable on their transcripts as courses in how to teach reading. Now I don't posit that to you as a horror story because I'm not so sure that the results wouldn't be twice as bad if they'd had twice as many credit hours. I'm perfectly willing to look at the figure, unhappily, from either direction.

What, in fact, then, has held up technology? First, price. Almost all the school budgets in the United States spend within a few percentage points of about 85 per cent on salary and labor costs. About 10 per cent is left for the amortization of the mortgages on the buildings, called bonds, and the remaining 5 per cent, 4 per cent, some places as low as 1 per cent, goes into the materials of instruction, from chalk and crayon to the primitive pieces of technology called books. This being so, I am old enough to recall when the first motion picture projectors brought into the schools were the result of many, many months of labor on the part of the good PTA ladies who raised the $600 necessary to buy the school what the school couldn't afford, a 16-millimeter projector. This was in the 1930's. There were isolated cases, of course, going back much earlier. Schools were still being built in the 1930's with projection booths, under the assumption that the inflammable film of the 1900's had not yet been displaced, that nitrate, explosive film was still necessary, that carbon arc projectors were all that could be used, and that the film had to be shown in the assembly hall to large numbers without regard to whether the children were ready for the film, interested in the film, or whether it was germane. Roots of that practice still continue.

Price, then, is a factor because education hasn't learned how to think about investment cost or return. Nobody who stays in business buys an instrument for the production of his goods without a careful examination as to whether or not that investment will lead to an improved product or a reduction in his current cost of producing the same product. And so if you come with a Warner-Swasey $250,000 cutting tool that will turn out parts for automobiles or a part for a smaller manufacturer, the businessman doesn't examine that $250,000 instrument in terms of its cost as a lump sum. He examines it in terms of whether or not the merchandise produced by that machine, in terms of the number of units produced, will, at its measurable output-cost, significantly reduce his cost or give him both a better product and lower cost. Education is absolutely, at this point in time, immune to this kind of consideration because education has never made an investment in the productivity elements of what it

takes to teach or the instructional process. So we have minor sums devoted to a number of by-product artifacts of technology called the radio, the record player, the tape recorder, the television set and the motion picture projector. These are still very tiny fragments of costs and they are used in the instructional process. But even when used well, their essential use is peripheral to the overwhelming bulk of the instructional time devoted to the classroom exercises and behaviors. So we just don't know how to think in terms of investment for production in education because we've never really been concerned about the production consequences—the product.

We have mass appraisals of our educational product, and I would dare say that many of us have assumed that it was easy to get information on educational achievement from the major cities in the United States. In our company, for example, we remembered that we had read, on more than one occasion, articles prepared by Fred Hechinger in the *New York Times* that had been front-page. We remembered them as official releases of the Board of Education. Well, I had put together a good group of mentally disciplined people, and we went after the files, and we read those articles over again. We found that they had been extraordinarly well written, and that you could, five days later, come away with the feeling that not only were they *New York Times*-authentic but that they had been the product of an official release. But in reading them again, we found that that was not true. So we called Mr. Hechinger's office, and we found that the *New York Times* had acquired this information by demanding it as a public right and over a long period of time had extracted it. Recently a new superintendent in San Francisco, a courageous man breaking this mold, Dr. Jennings, released for the first time in the history of that city mass data on education in the schools there. It has not yet been done, to my knowledge, in Chicago; we found that we couldn't get it for Boston; and we found that we couldn't get it for any one of twenty other cities. So we've had no open audit of consequences of productivity, and without that audit what point is there in making additional cash investments in a technology and improving a process if we don't know the state of the current process?

At least there's a strong sense of disquiet across the face of America. One thing which you can find harmony on, amongst all segments of our society, one thing on which the white backlash will agree with the black backlash, is that the schools are no good. And they all

demonstrate it by saying, "I don't want to go to that school, especially if it's with one of you." And so price has been a very severe hurdle. But more than price, a mentality about investment for production payoff is completely missing from the non-profit business—I can almost call it the unprofitable enterprise—of education.

Within the field itself, I would like to pick up Mr. Hechinger's points and carry them even further in terms of an indictment of the past five years of time-wastage in this field. People concerned with the exploitation of the computer have done themselves, and education, a disservice. The computer was not invented, and has not been increasingly perfected and improved, in the third generation of computer advance, by attempting to adapt the computer to the purposes of education. The "given" was not the nature of children and the manners in which they learn, but the capabilities of the computer and how these could be translated into an educational device. Semantics is an esoteric art at best, but it's frequently diagnostically revealing. Computer people, in talking about the point at which a computer would begin to teach, spoke of it as a terminal. For, to them, it was in fact a terminal. Visualize sitting inside the computer. Look out at the world from where the telephone connection cable comes to a booth in which a child is to be operated upon or to work with the computer. From that vantage point of looking from the inside out it is in fact a terminal. But to the educator, to the behavioral scientist looking at the process of learning, it's not a terminal, it's a beginning. For it is at that point that the behavior involved in learning must be demonstrated and exercised. The consequence of this outlook has been to concentrate on this already magnificent instrument, with some fantastic potential contributions to make to education, and ignore those contributions because of this emasculation of an understanding that what took place was not back at the central brain but at the behaving instrumentation that the child confronted in the booth. The booth has suffered in not having had devoted to it the technology and the engineering and scientific brain power necessary to produce instruments whose behavior would be relevant to a theory of learning. This has scarcely begun to be understood in the industry.

The third factor holding up the successful application of technology is a failure to understand that when instrumentation is to be the vehicle of instruction, the material (or, as the trade calls it, the software; to the schoolteacher, the instructional materials) begins to take an on entirely different shape and form.

A textbook, if you've been through this discipline, will turn out to be—whether it is a good book or a poor book—a crude instrument. For example, in looking at a body of prose and an accompanying picture nobody in the book generally says to you, "At this point look at the picture." Nor does it say, "Now go back and look again and see something else in that picture." But our textbooks are accompanied by instructional manuals called "teacher's manuals." Now for all of our snide witticisms about the ineptness of pedagogy, let me set to rest one point here. If, in fact, today's teacher's manuals were followed almost slavishly, almost unimaginatively, almost pedestrianly, the quality of instructional process would be at least three times better than it is today.

The teacher's manual asks the teacher to behave in certain ways in order that the teacher, interceding with the child and the book, causes the book to become, in fact, a learning instrument. It's the manual that says to the teacher, "Have the children look at the picture on page 46 and call their attention to. . . . When they have responded in such and such a way ask them what else in that picture or what's related to it. . . ." and so on. The text doesn't do this, you see, and if we come down to the first and most important textual material available to the instructional process—back to the question of reading—this becomes tremendously apparent. The beginning reader that's in the child's hands will not teach him to read without the intercession of a teacher who is guided by the three-times-larger volume called the teacher's manual. This manual, page by page, and frequently paragraph by paragraph, instructs that teacher in the use of related materials as well as those in the textbook in order to have the book become an instrument effective in teaching reading.

Now let us move on to technology. All technology, I remind you, is at best a dumb brute. It won't behave for one split second beyond the point at which you've told it what to do. If this learning booth contains within it instrumentation that talks, shows pictures, provides for a child to talk back and record and play back his speech, where he can type in response to instructions or his own will, and then modify what happens as a consequence of what he does; if this instrumentation has had fed into it detailed material carefully arranged, it is behaving as you would have a model human being, a master, dedicated teacher. This process imposes on instructional material a severity of carefully thought through, disciplined analysis vastly beyond the normal fudging capacity of a human being, who,

having carefully prepared himself to teach a given group of children, gives himself written instructions called a unit plan or a lesson plan that tells him what he intends to behave like in order to have those children learn. The teacher obviously does not write out a complete dialogue. He does not write out, other than the briefest of instructions to himself, about the blackboard use or the use of a map, or the turning to a text. Take him away now, and have that behavior performed by instrumentation, and that instrument stops, letter by letter, when you stop. It simply will not behave unless you tell it to behave with precision. It's the difference between a silent piano and a piano being played multiple notes at a time, chords, etc. The piano is a dumb brute until both musical score and a human being using the score make the instrument work.

In the kind of technology we are talking about, it is as if we need to write that music, not just for an instrument, but for an orchestration of instruments that are going to interact with the child in learning. That is, the picture machine, the prose machine, and the voice machine (whether they're activated by a remote computer or by a decentralized one) have to make their music in harmony with the learning. The complexity of this task is why the hardware people have generally stayed away from attempting to rewrite instructional materials. Those who have undertaken it, by and large, have backed off, once they dove in and found out the complexities involved. And so price, poor concepts of the terminals, and a narrow understanding of the design of the instructional materials have been three gigantic hurdles that most of the manufacturers have scarcely begun to surmount.

Lastly, the fourth obstacle undergirding all of these is an inadequate understanding of the nature of learning. In this I am saying two things. One, what we know about the learning process is grossly inadequate. Worse than the little that we know is the fragment within that little that has been used in technology. We have fallen in love with the medium rather than with the act of learning involving that medium. And so we have had T.V. technicians attempting to use the medium as an instructional device, borrowing from their vague memory of their own educational process. We have not had behavioral science devoted to analysis of learning process with an intensity needed to produce hardware that would behave in harmony with this analysis.

We talk about computer-assisted instruction today. We go to

exhibits and see a teletype machine with a great big thick telephone cable stuck into its innards, and we're told that it is connected to some remote city where the corporation has its master computer. Actually that teletype machine is simply a typewriter that will take commands from the computer and type by itself in front of you on those commands. Now anybody who can work with this method is already at a relatively high level of learning skill. He can read and he can typewrite. To reduce the magnificent potential of the computer to this impoverished sense of learning behavior is a crime for which those who are practicing it will get their just deserts here and now, not later.

The computer can do some things that education has literally never done before, except in rare and isolated instances with phenomenal children and accidental concurrences of the right teacher and the right child at the right time. For example, the computer can simulate; that is, the computer can be programmed to contain information and the way that information will act upon itself involving issues and problems. If children then are trained in how to attack a problem, they can engage at that level of skill learning, with the computer as a substitute for the real-life learning which is the hardest and most miserable way to learn anything. (That's why marriage is such a difficult thing—you can't learn it in the classroom.) That is, one can have an artificial duplication of the circumstances involved. These kinds of things involve "what would happen if"; this is thinking, and the schools have been a vast conspiracy to see that thinking doesn't take place. The computer has a tremendous contribution to make in this respect. To speak of the computer as "a million-dollar page-turner" or "copy-book maxims in practice or drill" is to invite education to swat flies with sledgehammers. And so when you see statements made that "we of this city or that city have a Federal grant of x million dollars and we're going to put on that program for computer practice and drill in arithmetic and reading," shudder. For they can do it better with 60-cent workbooks, which are the lowest form of pedagogy known to American education.

Now, what is the need in our society? I spoke of the fact that it is difficult to get school achievement data, and the reason is that every time you get it you realize why it has been hidden. I have spot-checked enough of the major cities to say this flatly. In the inner cities of America there is an educational tragedy taking place every

day. In America the first grade is the beginning reading grade. I think that that is about two years later than it ought to be, and that's really iconoclasm of the highest order. The evidence shows that at the end of the first grade, seventy-five per cent of the children in the inner cities are failures. That has nothing to do with those who get promoted to the second grade, for the process is repeated there.

Let me give an illustrative anecdote. We had a group of people from one of the ten largest cities in the United States with whom our sales force had met. Like salesmen, our people had become overly enthusiastic. It wasn't enough for them to say that our corporate instruments would do something better; they had to indicate that they would do something that had never been done before, and do it all tomorrow morning. When I joined this group after dinner, the director of curriculum in that city turned to me and said, "Dr. Martin, I can't go for these claims." I said, "What claims?" And he told me what I just indicated to you. I said "You mean they said that?" And he said, "Yes," and I said, "They repeat it again and I'll fire them!" This was an overstatement because they didn't repeat it again until the next day. He said, "We're spending a million dollars in this city this year and we've been down the road on ITA and on Words in Color and on this and that phonics system, and every one of those people told us that if you do this you'll get one hundred per cent." I turned to him and said, "You've got a miserable situation. How many children in your inner city schools?" He said, "About 45,000." I said, "About seventy-five per cent of those at the end of the first grade you can't even test. About twenty-five per cent of them have difficulty with their first names and fifty per cent can't finish their last names." The deputy superintendent of schools for that major city turned to the man who was talking to me and he said, "Joe, is he right?" And Joe said, "Give or take one or two percentage points, he's right."

It's true in New York, it's true in Chicago, it's true, it's true, it's true. You name the city. Now the depth of that tragedy is difficult for us to understand. But I'll make you understand it. For one hundred and eighty days children are sentenced to sit for 5½ hours a day, over a period of ten months, and minute by minute, hour by hour, that room, that climate, that setting, that teacher, that circumstance is saying to them, "You're dumb, you can't learn!" So when they don't learn to read, they *do* learn something else. They learn they're unable, they learn they can't, and that's why the figures,

consistently across the face of the country, from the Coleman report on, are that the longer they stay, the wider the gap in achievement scores. And this grinding, gradual deterioration of human beings is a product of the present system.

Our remedial patchwork attempts to do something about it are beautiful examples of the conflicts in our culture. We are a humane society. We are a charitable society. No civilization in all history has had the national compassion of this one. We give more than any group of people in the history of mankind, but we give to pathology, we give to correct or redress a wrong or grievance or condition. That outlook permeates the educational institution beautifully, happily, and ineffectively. The past two years of several billions of dollars in Federal aid have gone to what I call the compassionate aspects of education. That is, we have added, in satellite fashion, a whole host of peripheral, remedial, clinical, pathological correction approaches. We have hired social workers, community workers, psychologists, guidance counselors, remedial reading people, speech teachers—and I just spent, I think, the bulk of the Federal expenditures. And we have left relatively untouched and unchanged the central disaster, that is, what happens in the classroom in the reading situation at the very beginning and the very outset of a child's introduction to the world which tells him whether he can or he cannot, he's able or he's not, he's smart or he's dumb, he will learn or he will not learn. And you don't need Freudian clinical psychology to recognize that the scar tissue at age six is deep, penetrating and almost irremedial in subsequent years.

If ever there was a case for the need to get the mule out of agriculture, to get the ineffectiveness out of the system and to apply the hard, cold, dollar value productivity measures of industry to an institution that ought to be declared bankrupt, put into the hands of other receivers and redone with new technology, it is this one.

Mr. Fadiman:

Our third and last speaker is one of our country's distinguished humanists and scholars. He has made a reputation in several areas of scholarship, more particularly in the field of Shakespearian studies and the difficult and very rewarding field of our own colonial history. He is one of Washington's most eminent citizens, being director of the Folger Shakespeare Library. This city, as well as the country at large, owes a great deal to Dr. Louis Wright. Dr. Wright.

Louis B. Wright:

Dr. Martin has left me very discouraged. By trade, I'm a social historian, or try to be, and historians are not very optimistic people. As you look back down the long corridors of time you don't find much that encourages you. We in America have been a hurried people; we have been constantly in search of instant solutions. Dr. Martin has indicated that we haven't been hurried enough in solving one of our problems. I'm not sure, I wish I were, that any change in the system is going to be a vast improvement. I'm not sure that if we throw out all the incompetent teachers and add all the untried instruments we'll do the children any good. But don't misunderstand me. I think we should be careful not to neglect any of the mechanical aids available for instruction; and I'm sure that there has been a lot of residual prejudice. A vast deal of gadgetry is available to us and is very helpful. To deny the use of filmstrips, television, recordings, electronic devices of all kinds, would be like denying the value of maps in trying to teach history. But we run a risk today of relying too much on mechanical aids. I would use every mechanical aid that it's possible to introduce in any of the teaching processes. But as a people —I'm speaking now as a social historian—we have constantly relied too often on new gods. Mr. Hechinger has pointed out that we've been oversold on some of these things. Dr. Martin has confirmed the fact of the overselling of the American people on some of these things. Gadgetry cannot take the place of the human brain. But that's what a lot of us would like to believe. It cannot take the place of human personality in imparting knowledge. Most of all I think we need a tolerance as well as a wise skepticism. I have no solution for the educational process. I wish I did. But as a social historian, I wonder a great deal about what the current beliefs of a people may do to those people—namely to us.

Dr. Martin mentioned the master teacher. Now there is a fair amount of heresy about the theory of the master teacher. A few years ago the Ford Foundation laid up trouble for itself on earth and probably in heaven too, if anybody from the Foundation is headed that way, by announcing a wonderful solution to the teaching problem. A certain officer in the Ford Foundation announced that the Ford Foundation would find master teachers around the country and they would put their wisdom on tapes which would be televised to classrooms of the nation while lowlier mortals in the teaching profession, a sort of corps of nurses aides, would keep order, if they

could, while the students received the information from the masters flashing in front of them. Now this, to say the least, was a tactless statement to go out to NEA and it had its effect as you well remember. Before the Ford Foundation was rid of this experiment, it had cost them something on the order of $75,000,000. You could almost endow a university for that. They even bought some residual bombers left over from World War II, airplanes to provide mile-high aerials from which they sprayed the Middle West with educational fallout. So far as anybody can tell, this effort in finely machined education by master teachers did no whit of good to anyone except a few operators in the education business.

Everyone knows that there are not enough good teachers. In recorded history the world has never had enough good teachers, and there is small likelihood of the world producing enough now. So I concur with Dr. Martin's hope that we can provide instrumentation that will help, but I retain a certain skepticism, and I think all of us ought to be skeptical about the ultimate effectiveness of this. That isn't a counsel of defeat, however. We must keep struggling to improve good teaching. We must keep struggling to adapt the best of the instrumentation to the situations as we find them, as they develop. If we can give teachers useful mechanical aids, by all means let us do it. But let us not fool ourselves: there is no shortcut to instruction any more than there is any shortcut to learning. And one of our failings as a nation is the desire for shortcuts. Fifteen minutes a day, you see a correspondence school advertise, will give you a perfection in something or other, I forget what.

Some modern apostles of culture declare that we have reached a new plateau, if that's the word, and that our perceptions have been radically changed by electronic devices that affect and influence us: by television, by motion pictures, by radio, by rapid communication of all sorts. Now I think this is a dubious thesis for which there is no valid scientific proof. It's merely a notion to play with and to enrich one or two people. No one will deny the influence of new devices upon the imagination and even upon the behavior of considerable numbers of people. Rapid mass communication can account for much that happens today. It can even be argued, I think, that rapid communication is not a benefit. With every television reporter on the alert, any twitch on the Berkeley campus is known instantly on every other campus. If student rioting is currently fashionable, students elsewhere will feel a compulsion to riot. And within a few days

some newspaper pundit will see a new trend toward massive student unrest. Or maybe, if he's fresh out of college himself, he will discern a new seriousness and a deep concern among the youth of the land for social justice, or whatever it was among the youth that they said started their riots. It is even doubtful whether common language is a good thing. I have heard it argued earnestly that if England and the United States didn't understand one another so well they'd get along better diplomatically: that diplomacy, like opera, ought not be too well understood.

Much of the belief in a new human nature is factitious, fictitious, and manufactured. Some of our reactions do show an influence of the new devices of communication, but it is unlikely that these devices have in any way permanently changed human nature in the slightest degree. This is a part of the philosophy back of our instrumentation, I think, the notion that human nature has already been changed by these devices. I know there are a few pundits going around the land preaching this doctrine, but I don't believe it for a minute.

We forget that the human organism is a very tough bit of animate matter. For some thousands of years western man has been undergoing a process looking toward his civilization; like chunks of hard rock tumbling for centuries around a pothole in the stream bed, man eventually gets a few of the rough spots rubbed smooth. But he remains a very hard object with his essential instincts unchanged. Even the coating of cultivation and culture that he manages to appliqué onto that smooth surface is very thin indeed. Just how thin we have cause to remember in the manifestations of Nazi Germany.

A few years of television are not going to make a fundamental change in our characters. Television may merely set us back in the immediate behavior of the immature of all ages. The temptation is very great for some of us, awed by the wonder of new scientific devices, to foresee a completely new world with completely new types of inhabitants. Now that sounds exaggerated, but it is being preached today. Historians, I ought to warn you, are not convinced. We know that mankind has always been impressed with mysteries. Indeed, at the basis of all religion is mystery. Since large portions of the modern world have given up traditional religions, they have found a new faith in the mysteries of science. It would take too long even to enumerate a few of the actual gospels that are announced on Saturday on the religious pages of the newspapers, based on some pseudo-science. You can see the best examples in the *Los Angeles*

Times. But even in other papers, in cities less given to cults, you can see these new religions, new faiths, based on pseudo-science. What we do not understand well we make into a god. That has frequently happened among primitive peoples and we are still relatively primitive.

Most people who talk about computers, for example, have not the faintest notion of how they work or what they can do for us, but the computer is a new, mysterious, and a fashionable miracle and it is going to solve all of the problems of the universe in the minds of some people. Now don't misunderstand me; I am a director of an organization that is giving vast sums to carry on research in the use of the computer and the adaptation of the computer to information retrieval. I know how valuable it is, but I merely say: do not fall down and worship this new god. It is not going to save your soul. It is not even going to preserve your health, in spite of what the doctors have told you, and it is not even going to save you the necessity of using your brain.

Let me cite one instance of my own experience in the misunderstanding of this electronic device. A heresy is abroad that the computer is going to make the book obsolete. The time will come, say some of the prophets of the new faith, when we shall no longer need books, nor libraries to house them. All information will then be available on IBM cards or their equivalents. We will have only to sit at a console and push buttons.

Several things are wrong with that belief. The first is that it isn't so. The computer can, of course, cough up a vast amount of information if somebody has had the foresight to put that information into the computer. But who is going to program the multifarious facts and ideas that man now seeks in books? Another fallacy is the notion that books and libraries are merely designed to supply information. Factual information is only one aspect of the use of books. Books also minister to the esthetic needs of men and women. Since the invention of the alphabet most of the writings that have survived, if we except the sacred books of religion, have been works designed to inspire, please, instruct, and entertain the human race. If we merely want to learn all there is to know about the treatment of appendicitis, for example, perhaps we can appeal to the computer for aid. But we are not going to get much pleasure in the future merely from punching buttons on a console and getting a basketful

of information that some hired and perhaps tired laborer in the vineyard has thought to program for us.

Plato imagined that perfect truth or the perfect image was to be found in the empyrean, or somewhere above us, and that we dealt with imitations here below. When all knowledge is programmed for us by some hack worker we shall be a long way from Plato's perfect truth. Research then is going to be a dull business and most persons with live minds will seek some other activity. The notion of mechanizing our education to make all these things simple, foolproof, and easy to teach is one of the delusions of our age.

Let me repeat that I want, of course, to use every device possible. All I am saying is that we are a people easily deluded, and please, let us not be deluded by this. We, of course, have at hand vast numbers of new techniques, including video-scopes, tapes, and all the other improvements that we have heard about. We ought to make maximum use of everything that proves practically useful and desirable. But we must not believe that the problem of education is solved, any more than that the library problem is solved, by mere machinery.

There is a tendency today to believe that if we can make life easy and entertaining for the student, make it possible to learn without working, we have made progress. And I'm not talking about the tragic problems that Dr. Martin mentioned a while ago. But on another level we have fallen into this heresy. We live in an age of extreme permissiveness. Every mature mind might profitably read Jean Jacques Rousseau's *Émile* and *La Nouvelle Héloise.* And every immature mind ought to be forbidden to read them. For we have inherited a vast amount of our nonsense from Rousseau. He, incidentally, solved his special problem of educating his children by sending them off to a foundling home. We in America received a vast legacy from Rousseau: a legacy of permissive sentimentality which, combined with half-understood and decadent Freudianism, has brought us today almost to a state of social impotence. I wish I had time to develop this idea; if I live long enough I intend to do so. We scan the horizon, we historians; all Americans, all educators, scan the horizon like a mariner, shipwrecked on a desert isle looking for rescue. Prophets arise who tell us that our ignorance is not ignorance but a healthy adaptation of new conditions; that our permissive weakness and lack of any form of discipline, self-imposed or otherwise, is a healthy expression of the individual ego; that we

can place all our faith in a panoply of shiny new machines that require only tactile dexterity to admit us to the mysteries of life. If we believe these prophets we are fooling ourselves, just as Rousseau fooled himself and many of his own age.

If we do not take leave of our wits and run after false gods, if we make our machines our servants instead of our deities, then we really have an opportunity to benefit enormously from the electronic developments of the present day, and the day about to dawn, because we are just at the beginning. But we face a very real danger if we believe all we read in science fiction. The construction of an important college library in the Middle West has been held up for several years because one member of the board of trustees is convinced that books will soon be obsolete and the college will not need to go to all that expense. The college may have to wait until they bury that benighted trustee, but the book is going to outlast him.

Human nature, I want to insist, is going to remain pretty much the same, too. We are not going to be transformed overnight into new beings by television and other mass media. We may have a lapse into a dark age of ignorance, but perhaps we shall recover. Someday we may learn to master all of the machinery that we have invented. That is, if we survive at all. There now exists a distinct possibility that some tinkerer with nuclear fission will punch the wrong button. Near the end of the sixteenth century Tycho Brahe wrote a treatise on a bright new star. It was a nova, a blazing star, that excited all Europe. Some other astronomer, a galaxy away, one day may chronicle in similar fashion our brilliance. In the meantime, to save our skins, we're going to need to use our minds. We cannot depend exclusively on electric pushbuttons. Someone just possibly might push the wrong one.

There are a lot of questions that I think we ought to ask on the practical level. I've been talking from an historical point of view. Will more machines in the classroom add to the complaints about the de-humanization of education? Human beings are rapidly becoming mere numbers—each of us is a social security number and a bank account number; there are some people in durance vile who are just plain numbers. Will the substitution of machines convince the student that he's merely a robot in a robot world? Will machine education merely accelerate graduation to the industrial assembly line?

We hear complaints about the lack of creativity in the modern

world, or the lack of opportunities for creativity. What is machine education going to do about that? The answer may be that it will give you, as adults, more leisure, but leisure for what? More electronic entertainment, and of what kind?

How can the machine serve as the stimulant that comes from the give and take of personal discussion? It may be that that typewriter can talk back. It may be, if the student is sufficiently sophisticated, he can get the kind of contact from the machine that he gets from a human being. If the human being with whom he is in contact is a mediocre human being, he may get better stimulation from the machine. But that we have to prove. It is extremely difficult to talk back, at the present moment, to a television announcer, although some of us have tried.

Will the machine help to induce wisdom? It may impart information, but what of the personal influence that a few great personalities have had? Perhaps someone will say that there are not enough great personalities, that maybe through television or some other means we can project great personalities further than their influence is presently projected. But has any personality on the movie screen ever had a profound influence in inducing wisdom? The movie screen has induced something or other, but wisdom?

What is going to happen when the novelty of the machine wears off? When we are reduced to boredom with the idiot box? With what are we then going to be left? Are we going to feel intellectual loneliness in the presence of inanimate devices? There is a great deal of complaint about the intellectual loneliness of students.

Even more practical questions arise. How expensive are the electronic devices? How subject to student vandalism? What happens when a disgruntled student cuts the wires in an expensive piece of apparatus? Some schools in Washington can't keep window panes in their windows today, or even the ceilings overhead intact. If you read the *Washington Post* most of the last week, you could see that confirmed. How useful are valuable fragile machines going to be under such circumstances? How long is it going to take teachers to master the technique of using electronic apparatus? And how long will it take students to adapt to the new environments? Much of the complaint against education today is that it is factory-like; that is, lacking in human sympathy. The complaint stretches from Berkeley to the ordinary grade school. Is it valid? Will the machine further remove the inspiration and the human sympathy that young

children, especially, need? And lastly, what sort of future are we heading for? What do we want? What sort of people are we training? And for what purpose? These are fundamental considerations. The imparting of information is not all that we require.

We are faced, as Dr. Martin said, with a tragic dilemma. There is no easy solution. And, as I see it, one of the great dangers is that some people, some people perhaps in authority like the trustee of the Middle Western institution, will think that there is an easy solution, will buy from the salesman some gadgets, and think that's all that is required. The solution is perhaps the most difficult one facing America today. How are we going to master the machines that we've created? How are we going to control the scientific devices that are now available and perhaps sometimes in the hands of incompetents?

QUESTIONS FROM THE AUDIENCE

Q. Dr. Martin, you've talked about the fact that the student was taught that he could not learn. And I know that there are things about programmed instruction that can teach him that he can learn. But I haven't any specifics, and I'd like to know what your experience has been and what proof there has been or what methods were used to prove that the student can learn and to bring him along.

Dr. Martin: We've had a number of experimental situations. I conducted probably the earliest one in the public schools with the so-called "talking typewriter." You see, I have saved until now my own commercial. This experiment was simply to determine whether or not the machine could teach five-year-olds, who traditionally in our schools are not taught to read because that's kindergarten age, whether or not the machine could teach effectively those children from a carefully selected sampling—from mental retardates to moderate intelligence to superior I.Q.'s, from a diversity of economic income, families, race and sex divisions and so on. Whether or not that could work as well as, or better than, or at all competitively with, two seasoned, mature, extremely able teachers teaching a controlled population in the best circumstances that could be devised. Instead of the standard American education experiment in which the control group is given nothing and the experimental group is given something, we did it in reverse. We gave both horses the best riders we could to see what would happen. And the answer was that the

machine taught all the population better than could be done under the best circumstances we could devise, including, by the way, the four mentally retarded children in the group. So it works. It works not as a panacea, not as a cure-all; there are a lot of unanswered questions. But what we have done is to impose on it a discipline that I think would delight Dr. Wright here. We have done it unheralded. I'll say it out loud for the first time publicly: we will not sell our instruments to every customer. We satisfy ourselves as to the competency and sincerity of the people and the resources they have to bring to the task. In addition to that, we've had instruments in a school, and I can say to you that their revenue to the corporation I represent was in excess of $100,000 a year, where we wrote them a peremptory letter saying that an investigating team had indicated that they were mismanaging the project, that there was political manipulation and exploitation for political purposes, and that the design and controls were being violated, people attempting to do a job being interfered with, and unless those conditions were rectified to our satisfaction we'd cancel the contract and withdraw the machines. We did do just that. For we're thoroughly persuaded, on the same humanist basis as I think Dr. Wright was talking about, that while the machine is no panacea, the capacity for the people to abuse children through it is also there as a potential, and we're determined that that will not take place.

Q. I'm not sure that Dr. Martin was responsive to the question, at least not as I understood the question. Dr. Martin, you concluded your comments by a very dramatic indictment of the schools in the inner city, and I got the distinct impression that this could be corrected by your machines. How? I believe this is what the question was, at least the question I recognized.

Dr. Martin: All the conditions afflicting the schools in the inner cities won't be corrected by anybody's machine or even machines not yet made. But I addressed myself to what I thought was the nub, the one central issue, and that was the beginning reading situation in those schools. There, I think, instrumentation has a very significant and corrective role to play.

Q. Dr. Martin, in your experiment with the two groups, the machine group and the master teacher group, did you use a nursery reinforcement for the children who were on the machines, or was it strictly a machine-type program?

Dr. Martin: No, they came to school so they had kindergarten.

Q. In programming your typewriter experiment, what textbook or system did you use as a basis for the words that you selected for them to learn?

Dr. Martin: Their words and their language is the initial program content, individually determined.

Q. Each child?

Dr. Martin: Each child in the initial process.

Q. Was this a phonetic basis at all?

Dr. Martin: Yes, that continues from there, but the initial process is the child's own work, the child's own stories, the child's own language, each child.

Mr. Fadiman: No selected word list or textbook use?

Dr. Martin: God save us from that.

Q. Dr. Martin, I want to know what training should be given to prepare the new teacher for this coming revolution. I mean, it's going to come, we're going to have more technology and so forth, and yet many of our schools are still educating people for a time that's past. I'd like to know what training you think should be given to the people who will be dealing with this, or to all teachers for that matter.

Dr. Martin: I'm not going to evade your question. It's just too long to answer so I just won't even try.

Q. Dr. Wright, the amount of information to be acquired seems to be much more demanding on the person than it was, say, a century ago. Is it possible to educate all teachers, in the time available, to achieve this amount of knowledge without some new sources of help?

Dr. Wright: I don't think all people can know all things. The Renaissance had an ideal of the well-rounded man, as you know. He had to know a little of everything. Knowledge has expanded in our world to the point where it is impossible for us to know everything. I think it is essential for the individual who is going to teach to realize that he must specialize in some area of knowledge, and equip himself in that particular field if he is going to have competence to teach. I think there ought to be as much general knowledge as is possible for the human being to attain, but individual capacity for

attainment varies; so I don't think there is any easy answer to that one.

Q. I would like to ask either Dr. Martin or Mr. Hechinger, in relation to this investment, how is the most forward-looking superintendent or the most forward-looking school board going to raise the money?

Mr. Hechinger: Well, I think it's always a question of how, first of all, you use the money that you get. In my particular city we now spend a little over a billion dollars a year for public education. This money is committed to be spent in certain ways. It doesn't mean that the commitment is necessarily the right one, or that it is unchangeable. If one method of budgeting or one approach to education promises to work better than another, then I think you have to shift the funds. This is one aspect of it. Now you can add to this. I think probably Dr. Martin will probably agree that almost any superintendent feels that he could use more money. In most instances this is probably true. That's a political question: How do you get the money?

Q. I will direct this question to Dr. Wright. I think you made several references to the coldness, the mechanical aspect of the so-called technology, and I wonder if you could not apply that same description to the product that you happen to deal in. As far as the end product, bounced out of some paper mill, the printer's ink smeared on it, and rather abstract lettering put in it, it is certainly unnatural, and in its day was probably just as cold and mechanical as some of this modern day technology that we are dealing with. In other words, wasn't the book just as cold and mechanical in Gutenberg's day as the machine is now?

Dr. Wright: Oh, I think it would be much better to go back to the primitive cave man when we could just sit by the fire and stay warm, but man evolved the process of reading which added something to his emotional and esthetic enjoyment, and he hasn't found reading necessarily a cold and a chilling experience. I realize that some writing today is cold and chilling. I haven't read a modern novel recently that didn't chill me to the bone, but there is a great deal of literature that is warm, emotional, and stirring. There is a great deal of poetry that is warm, emotional and stirring. I think that after the monks multiplied books and men learned to read, they found it not too cold and chilling. Perhaps, to follow your logic, we will find

sitting at a console punching buttons one day just as thrilling as we find reading Dante's *Divine Comedy*. I'm too old for that.

Q. (same man) I might suggest, then, that the material that is in this early hardware, if I can call it that, is dependent on the program just as much as the value of anything coming from our modern resources would depend on the program and could be just as humane as the programmer was warm and human.

Dr. Wright: The programmer must be warm and human, that is, assuming that we are going to have programmers who will be Shakespeares and Dantes, and Cervantes and various other things. I'm very happy to say that I'm not going to be here to see the culmination of this.

Q. Dr. Martin, you said the stress is being placed in the wrong places. I think that the software is what should be stressed and not the hardware. I view a book as hardware, I view a teacher as hardware. What a book gives across to the children is the software, just as what the teacher presents in the classroom is the software. In other words, the message is the software, and I think if we put emphasis on that, on the software, what is done, what is done in the classroom where the teacher lives every single day and the students, this is where the message is going to get across, this is where Responsive Environments has to work out their problem, what they're going to put on their interphases, what they're going to put in the isolation booths, how they're going to motivate, how they're going to stimulate for creativity. Dr. Wright is the only one that mentioned creativity, and this is very close to my heart. I am an art consultant for the D.C. public schools, and creativity is something I work with every single day. I reach these children, not with a book, but with crayons and paints, and I reach them very deeply. I reach into their hearts and into their emotions. Maybe I am not a master teacher, maybe you can program me, but I am working on the software, I am working with the machine. Maybe there is only one overhead projector in my whole school system but I work with it. I find it in a basement, and I get out the plugs from someplace, and I dig it out and I put it in the class and I show the teachers what can be done with that overhead projector. I am working with software; the machine does not matter to me, it is what I project. It can be a camera, it can be an overhead projector; it is what is put on, it is what is done in the curriculum, how this machine is worked in with the work that is done every single day in social studies, in history, and in science and in art. All these

things are tied in. It does not matter what the hardware is; it is the software that counts.

Mr. Fadiman: Thank you very much. I do not think that was a question addressed to Dr. Martin, but I gather it was an order.

Q. Along the line of the comment just made, I presume, and I think it was implicitly stated here, that these adjuncts of teaching are just that, not a replacement of the teacher. These are tools for the teacher, I think it was implied with what was stated here. I have a question for Mr. Hechinger. He seems to indict the manufacturer for trying to oversell the machines when they first came along. Do you not think that perhaps the educators must also have a responsibility in which they have been delinquent? They have not sufficiently interacted with the manufacturers to prescribe what are the needs. Along these lines you mention the Annapolis project. At the college level, which I am most familiar with, it seems that professors throughout the country are just about as far from the use of any kind of video systems or computer systems as possible. There in Annapolis they have taken the leadership, at the undergraduate college level, in attempting something in this direction, and I think, as a member of the Office of the Naval Research, I am justly proud of that.

Mr. Hechinger: I will reaffirm what I said before. I blame the educators very much for not being interested, for not forcing the manufacturers. If you are in this field you go ahead, if the educators don't work with you, and use whatever knowledge, whatever expertise you have. I think this is very much the fault of the educators. I do, however, want to say to the first part of your statement, and I think Dr. Martin would agree with this: I don't think we can look at the technology as simply an adjunct, any more than the book is an adjunct to education. I think if you look at the process of learning, if you assume that the things that a teacher uses are simply an adjunct, then they are not going to work. Then they are largely going to be wasted. Teaching is being done by the teacher together with an enormous number of other things, and of course by the student, and the book is not an adjunct. And Dr. Martin's machines are not an adjunct to the teaching process. The failure in the past has been that too often the devices are brought in at a time when the teacher feels he needs a rest and the children know this. If something is not pertinent to the teaching process it should not be used at all.

Q. I think this question might be directed to all three—whomever would like to comment. There has been a recent trend in the area of

this new hardware and software for giant electronic communications companies to buy out most of the software companies, which could result in the not too distant future in all the program materials in new technology being dispensed by four or five or six giant corporations throughout the United States. I wonder if any of you would care to comment about the good or bad or what we could expect from something like this.

Dr. Martin: All of us in our society have a sense of dread about monopoly, about gigantism, and certainly that sense is compounded when it begins to affect the materials of instruction, curriculum, and so on. I am hopeful that, like every new industry in our history, there will be, as there has been coming the last few years, a rise in the number of new corporate entities moving into publishing and educational technology. Whether or not the current giants and their merging of publishing and electronics will necessarily reverse that pattern of airplane industry, automobile industry, and the electronic industry itself historically, there is a period in the beginning when there is a tremendous proliferation of small industries, followed by their mergers, fallouts, bankruptcies, and consolidation. This has been the pattern. Now whether or not this current stage is going to produce just simply a giant few to monopolize the materials of education remains to be seen. Personally, I, not from a corporate position, but simply as an American citizen, and as a former teacher, would think this is to be guarded against, and to be concerned about.

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